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ABSTRACT

This study involved a literature review aimed at identifying: some of the significant causes and correlates of mathematics anxiety, significant treatments of mathematics anxiety, and significant methods of prevention of mathematics anxiety. The annotated bibliography is structured under these three headings. Three categories of correlates of math anxiety are identified: mathematics achievement, mathematics attitude, and sex differences. The treatments of math anxiety were generally grouped into the use of anxiety reduction techniques or the remediation of math skills. It was determined that prevention of math anxiety begins with teachers, and that teaching strategies that build positive and realistic self-concepts can prevent the development of math anxiety. (PK)

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MATHEMATICS ANXIETY:

CAUSES AND CORRELATES, TREATMENTS, AND PREVENTION

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Indiana University at South Bend

Master's Exit Project

Spring 1988

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INTRODUCTION

Mathematics anxiety is an important educational issue today. It is hindering students progress in mathematics in numerous ways (Austin-Martin, Wadell, and Kincaid 4; Buckley and Ribordy 6; Dew, Galassi, and Galassi 582; Hendel, 1980, p. 222; Kincaid and Austin-Martin 6; Wooley 6; Wright 34). This paper discusses mathematics anxiety in three aspects. These aspects are the causes and correlates of mathematics anxiety, the treatments of mathematics anxiety, and the prevention of mathematics anxiety. Each of these three aspects of mathematics anxiety are reviewed within the annotations of the literature and summerized. From this, conclusions are drawn and recommendations are given concerning each of the aspects of mathematics anxiety.

STATEMENT OF THE PROBLEM

Mathematics anxiety is hindering students today from obtaining necessary mathematical skills (Austin-Martin, Wadell, and Kincaid 4; Buckley and Ribordy 6; Dew, Galassi, and Galassi 582; Hendel, 1980, p. 222; Kincaid and Austin-Martin 6; Wooley 6; Wright 34).

PURPOSES OF THE STUDY

There were three main purposes of this study. The first was to identify some of the significant causes and correlates of mathematics anxiety. The second was to identify significant treatments of mathematics anxiety. And the third was to identify significant methods of prevention of mathematics anxiety.

LIMITATIONS OF THE STUDY

There were quite a large number of research studies completed within the last decade concerning the many aspects of mathematics anxiety. Many of the studies, though, found only few significant results concerning mathematics anxiety. Some studies found significant results within variables where other studies found no significant results or relationships within those very same variables. Also, there was only a small, limited amount of research concerning the treatments and prevention of mathematics anxiety. These limitations listed became apparent when comparing the summaries of annotations which follow.

ANNOTATIONS: CAUSES AND CORRELATES OF MATHEMATICS ANXIETY

Austin-Martin, George, Linda Wadell, and Marylou Bulter Kincaid. "Correlates of Math Anxiety in Female College Freshmen." Report. October 1980.

This research studied the correlates of math anxiety in female college freshmen. The subjects consisted of 377 female college freshmen at a small, midwestern, private women's liberal arts college. It was found that the relationship between math achievement and math anxiety was negatively correlated. Math anxiety was also found to be negatively correlated with confidence to learn math. And females with lower math anxiety viewed math as more useful than did females with higher math anxiety. A significant correlation was also found between math anxiety and the number of high school math classes taken. Lastly, there were no indications that parents' occupations were a factor in students' math anxiety.

Bander, Ricki S., and Nancy E. Betz. "The Relationship of Sex and Sex-Role to Trait and Situationally Specific Anxiety Types." Journal of Research in Personality 15 (1981): 312-322.

The extent to which sex and sex-role identification were related to individual differences in general or trait anxiety versus anxiety in situations of varying degree of sex-appropriateness was studied. The A-Trait Scale of the State-Trait Anxiety Inventory and the S-R Inventory of Anxiousness were used to measure trait anxiety. The subjects were 101 female and 79 male undergraduate students at a large midwestern university.

The S-R Inventory, which emphasized physiological/autonomic indicators of anxiety gave more comparable levels of anxiety than did the STAI A-Trait, which emphasizes cognitive and affective responses. It was found that females reported higher levels of anxiety, and that the strongest contributor to the differing amounts of anxiety between males and females was math anxiety, associated with a stereotypical masculine domain.

Bohuslov, Ronald L. A Method for Dealing with Attitudes and Anxieties in Mathematics. Diss. Nova University, March 1980.

Five mathematics attitude rating scales were given to approximately 150 students in beginning Algebra at the College of Alemada. These rating scales were the Attitude Toward Mathematics Scale, Attitude Toward Teacher Scale, Mathematics as a Male Domain, Usefulness of Mathematics Scale, and Mathematics Anxiety Scale. It was found that for women there was a conflict of attitudes toward earning top grades and letting others know they earned top grades. Also negative attitudes toward mathematics were more pronounced for women than for men. Women, more than men, responded that mathematics was a male domain. Women said that math was primarily job oriented, while men said that math was useful throughout life. And results showed that high test anxiety on mathematics tests was experienced by both men and women.

Brown, Rose Marie. A Determination of Attitudes Toward Mathematics and an Analysis of Factors Which are Associated with Negative Attitudes Toward Mathematics of Students at an Urban Community College: A Descriptive Study. Diss. Wood University, 1979.

The main purpose of this study was to discover some of the sources of negative attitudes toward mathematics displayed by community college students. It was found that the attitudes toward mathematics of males was more positive than females. There was no significant difference found in the achievement of students with negative and positive attitudes toward mathematics. Students with negative attitudes, though, exhibited high degrees of math anxiety with high statistical significance. There was a statistical correlation found between attitudes toward mathematics and personality characteristics such as dominance, capacity for status, sociability, social presence, self-acceptance, and sense of well being. It was also noted that the females enjoyed math more in elementary where as the males enjoyed math more in high school.

Buckley, Patricia A., and Sheila C. Ribordy. "Mathematics Anxiety and the Effects of Evaluative Instruction on Math Performance." Report. May 1982.

This study had three purposes. First, it investigated math performance as a function of math anxiety, while investigating the relationship between math and test anxiety. Second, it examined the effects of evaluative stress on high and low math anxious students' test performance. And third, the relationship between math anxiety and sex-typed versus adrogynous sex-role identification was examined.

It was found that high math anxious students performed significantly poorer on the math performance measure than the low math anxious students. A significant inverse relationship between math anxiety and math test performance was also found. And sex-role identification was not found to relate significantly to math anxiety.

Butler, Marylou. "High Math Anxious Female College Freshmen: What Do They Have in Common?" Report. August 1981.

The relationship between mathematics anxiety in highly math anxious female college freshmen and their attitude toward and achievement in math was studied. The subjects of the study were 344 female freshmen at a midwest liberal arts college. There was no clear relationship between math anxiety and attitudes toward mathematics, or between math anxiety and the total number of mathematics classes taken within the group. It was found, though, that the most highly math anxious students were the least confident in their mathematics skills.

Chisholm, Carol. "Correlates of Math Avoidance Responsible for Filtering Individuals from Math/Science Areas." Master's Thesis. Towson State University, June 1980.

This study attempted to define and measure the construct of math avoidance as well as to determine the primary predictors from a bigger set of variables. Five hundred people from differing age groups and occupations were used as subjects. One of the five significant predictors of math avoidance was math anxiety. It was found that males and females, in general, did not view math as a male domain, that females showed slightly more desire to be competent in math than males, and that females were slightly less confident than males in their mathematical skills.

Dew, K. M. Harriss, John P. Galassi, and Merna Dee Galassi. "Math Anxiety: Relation with Situational Test Anxiety, Performance, Physiological Arousal, and Math Avoidance Behavior." Journal of Counseling Psychology 31 (1984): 580-583.

In this study the relationship of math anxiety to situational test anxiety, performance, physiological arousal, and math avoidance behavior was investigated. The subjects were 63 undergraduate students. It was found that math anxiety and test anxiety were related, but not identical. Also, math anxiety and performance were significantly and inversely related. And math anxiety was found to be very slightly related to physiological arousal and unrelated to math avoidance behavior.

Docking, Russell A., and Jennifer A. Thornton. "Anxiety and the School Experience." Report. 1979.

This study investigated the relationship between anxiety and student/teacher interaction, peer interaction, academic achievement, and vocational decision making. It was found that anxiety in an academic area increased as the mathematical content in that area increased.

Frary, Robert B., and Jeanne L. Ling. "A Factor-Analytic Study of Mathematics Anxiety." Educational and Psychological Measurement 43 (1983): 585-593.

This study evaluated relationships between attitudes toward mathematics and other personality characteristics to see if mathematics attitudes were a reflection of other personal attitudes. These relationships could then give clues as to treatment, control, or prevention of negative attitudes toward mathematics.

Five mathematics attitude scales were administered to 491 students enrolled in mathematics courses at a large, moderately selective state university. Also, two personality constructs were measured, and six factors of biographical data were collected. It was found that negative mathematics attitudes were independent of other personality variables and recommended that all students be encouraged to strive for personal success and enjoyment in mathematics while being convinced of the importance and usefulness of mathematics.

Fullerson, Katherine F., John P. Galassi, and Merna Dee Galassi. "Relation Between Cognitions and Performance in Math Anxious Students: A Failure of Cognitive Theory?" Journal of Counseling Psychology 31 (1984): 376-382.

Differences in mathematical problem solving cognitions between high math anxious and low math anxious students were studied. The MARS was used as the screening device. It was found that cognitions during mathematical problem solving did not differ as a function of mathematics anxiety and sex. And cognitions were only marginally related to performance.

Gourgey, Annette F. "Development of a Scale for the Measurement of Self-Concept in Mathematics." Report. 1982.

One of this study's two purposes was to develop a reliable and valid measure of mathematical self-concept. The second was to clarify the relationships of mathematical self-concept to mathematics anxiety and to mathematics performance. The author states the definition of mathematical self-concept as beliefs, feelings, or attitudes regarding one's ability to understand or perform in situations involving mathematics. One hundred twenty undergraduate and graduate students enrolled in a basic statistics class were the subjects of this study. A Mathematical Self-Concept Scale consisting of 27 scale items was developed to reflect the subjects' attitudes toward their ability in mathematics.

It was found that mathematical self-concept correlated moderately high with mathematics anxiety measured by the MARS. And mathematical self-concept correlated even higher with acceptance of erroneous beliefs about mathematics, arithmetic skills, and performance on the midterm exam. Finally, the number of years since the last mathematics class was related more strongly to mathematical self-concept than to mathematics anxiety.

Gourgey, Annette F. "The Relationship of Misconceptions About Math and Mathematical Self-Concept to Math Anxiety and Statistics Performance." Report. April 1984.

Three major areas were studied. The first was to find the relationship of math anxiety to acceptance of misconceptions about mathematics and to self-concept of math ability. The second was to find what beliefs about math, mathematical self-concept, and arithmetic skills contributed to math anxiety and to performance in a statistics course. And the third was to find if beliefs about math and mathematical self-concept discriminated between groups of varying anxiety and performance levels. The subjects were 92 undergraduate and graduate students. The Beliefs About Mathematics Scale, the Mathematical Self-Concept Scale, and the MARS were administered to the subjects.

It was found that math anxiety correlated positively with acceptance of erroneous beliefs about math and negatively with mathematical self-concept. And misconceptions, mathematical self-concept, and arithmetic skills were significantly related to performance in the statistics course.

Hackett, Gail. "Role of Mathematics Self-Efficacy in the Choice of Math-Related Majors of College Women and Men: A Path Analysis." Journal of Counseling Psychology 32 (1985): 47-56.

This study attempted to develop and refine a causal model for choosing a math-related major through use of the variable math self-efficacy. The subjects were 262 undergraduate students. It was found that math/science relatedness of major choice had significant correlations to gender, years of high school mathematics taken, ACT math scores, and mathematics self-efficacy. The highest correlation was found between math/science relatedness of major and mathematics self-efficacy.

Hendel, Darwin D. "Experiential and Affective Correlates of Math Anxiety in Adult Women." Psychology of Women Quarterly 5 (1980): 219-230.

This study attempted to determine the background characteristics of math anxiety, to relate math anxiety to other academic anxieties, to determine the contributions of other variables in relation to predicting math anxiety, and to determine the importance of math anxiety in predicting arithmetic performance. The subjects were 69 women in the Math Anxiety Program at a large midwestern university. It was found that subjects who had played math games as a child had lower MARS scores. There was a high negative correlation between math anxiety and math performance. Math anxiety also had high correlations with test anxiety, fear of negative evaluation, and debilitating anxiety.

Kincaid, Marylou Butler, and George Austin-Martin. "Relationship Between Math Attitudes and Achievement, Parents' Occupation, and Math Anxiety in Female College Freshmen." Report. January 1981.

The relationship of math anxiety in female college freshmen to math attitudes, math achievement, and parents' occupation was studied. The subjects were 377 female college freshmen at a private womens' liberal arts college. Significant differences were found between high and low math anxious subjects' confidence in learning math. The belief that math is a male domain and attitudes toward success in math were significantly and negatively related to math anxiety for high math anxious subjects and significantly and positively related for low math anxious subjects. Achievement in math was unrelated to math anxiety in high math anxious subjects and significantly and positively related in low math anxious subjects. Also, no significant differences in math anxiety were found in relation to parents' occupation.

Lin, Yi-Guang. "College Students' Attitudes Toward Mathematics." Perceptual and Motor Skills 54 (1982): 460-462.

This study attempted to understand the characteristics of college students' attitudes toward mathematics and investigated possible differences in mathematics attitudes between mathematics majors and other majors. The subjects were 434 college students at the University of Michigan. Students of other majors said more often that math was confusing more than it was helpful. Even so, all majors stated to a high degree that mathematics was highly valuable.

Lips, Hilary M., Anne Morrison, Susan Brenner, Patricia Fergusson, and Carol Guest. "Self-Schema Theory and Gender-Related Behaviors: Research on Some Correlates of University Women's Participation in Mathematics, Science, and Athletic Activities." Report. 1985.

The study examined the cognitive correlates for women in the areas of avoidance of math and science, and non-participation in athletics. The most common reason for women not taking math or science courses was lack of interest. There was clear evidence found that self-descriptors in the math/science dimension were related to performance, but there were no significant results found where self-schemas had any direct effect upon women's participation in math, science, or athletics.

Lips, Hilary M. "Math/Science Self-Schemas and Curriculum Choices among University Women." Report. 1984.

The self-schemas for math/science ability among female university women were the focus of this study. The sample consisted of 466 female university students. A clear relationship between self-schema and self-efficacy for math was found. And the most frequent reason for avoidance of math and science by these women was lack of interest.

Llabre, Maria Magdalena, and Eduardo Suarez. "Predicting Math Anxiety and Course Performance in College Women and Men." Journal of Counseling Psychology 32 (1985): 283-287.

This study's purpose was to determine if math anxiety predicts math performance, the extent to which math anxiety can be explained in terms of general anxiety or achievement motivation, and if the degree of stereotyping math as a male domain can explain differing levels of math anxiety. The sample consisted of 112 female and 72 male private university students. Women reported statistically higher math anxiety on the revised MARS. Women were found to stereotype math as a male domain less than men with statistical significance. And women also received higher grades than men with statistical significance.

McAuliffe, Elizabeth A., and Cecil R. Trueblood. "Factor Analysis: A Tool for Studying Mathematics Anxiety." Report. April 1986.

This study's three goals were to identify the factor structure of the MARS and other rating scales, to determine what extent the MARS was related to these other rating scales and other organic variables, and to examine the intercorrelation among the factors of these rating scales and the selected organic variables. The sample was made up of 138 preservice elementary and special education teachers. Factors associated with each rating scale were identified. The factors associated with the MARS were evaluation, performance, and quantification. It found that the factors of the MARS correlated significantly and positively with many of the factors of the other rating scales studied, especially the Suydam-Trueblood Attitude Toward Mathematics Scale (MAS).

Meece, Judith L. "Sex Differences in Achievement-Related Affect." Report. 1981.

This study examined the role of affect in course enrollment decisions and achievement for 250 junior and senior high school students. Overall, the students reported relatively positive feelings toward mathematics, but the females reported higher levels of dislike, worry, lack of confidence, and anxiety. There was a tendency for boys to rate their mathematical ability higher than girls. Boys also perceived math as more valuable and useful. Students' ratings of their own math abilities had the strongest influence on anxiety levels. Anxiety was negatively associated with higher grades in math. And it appeared that the more negative students felt toward their math abilities, the more they lowered math's perceived usefulness and importance.

Miller, Diane. "Math Anxiety and College Freshmen." Report. November 1981.

This study's purpose was to determine the level of math anxiety in college freshmen in various math classes. There was a highly significant correlation found between math anxiety and the student's liking of mathematics.

Payton, Jacqueline, and Brenda H. Lloyd. "Math Attitudes and Computer Attitudes among College Students." Report. October 1984.

The relationship between math attitudes and computer attitudes was studied. The sample consisted of 105 college students. A significant positive relationship existed between lack of math anxiety and enjoying math. The correlation between math as a male domain and math attitudes was positive but relatively low. And the correlation between math attitudes and computer attitudes indicated a low to moderate relationship between the two.

Pedersen, Katherine, Dorothy R. Bleyer, and Patricia B. Elmore. "Attitudes and Career Interests of Junior High School Mathematics Students: Implications for the Classroom." Arithmetic Teacher 32 (1985): 45-59.

The article reported the results of a study on 1937 seventh and eighth grade students from a midwestern state. The study examined attitudes toward mathematics, spatial visualization, career interests, and academic plans relative to mathematics achievement. It was shown that seventh grade females had a significantly higher correlation with confidence in learning math, usefulness of mathematics, attitude toward success in mathematics, effectance motivation, and math as a male domain than did seventh grade boys. All females' scores decreased from seventh to eighth grade except attitude toward success and math as a male domain. And all males' scores increased from seventh to eighth grade except effectance motivation. There was no significant correlation found between different career interests and mathematics achievement. Both males and females were less likely to plan to take high school mathematics classes in the eighth grade as compared to when they were in the seventh grade, but the change for males was not significant.

Pedro, Joan Daniels, Patricia Wolleat, Elizabeth Fennema, and Ann DeVaney Becker. "Election of High School Mathematics by Females and Males: Attributions and Attitudes." American Educational Research Journal 18 (1981): 207-218.

This study attempted to identify important variables that related to the election of math courses for both males and females. The variables studied were attitudes, causal attributions, and achievement. The attitudes studied were usefulness, anxiety, mathematics as a male domain, and effectance motivation. The subjects were 633 female and 572 male students in two midwestern states. The Mathematics Attribution Scale was used to measure attributes of success and failure.

It was found that the variable having the strongest relationship with the mathematics plans of both sexes was usefulness. Anxiety, success-environment, success-ability, and failure-ability were also significantly related to females' decisions, while anxiety, success-ability, effectance, and mathematics as a male domain were significantly related to males' decisions.

Powers, Steven, Melissa Choroszy, and Peggy Douglas. "Attributional Profiles of Japanese-American and Anglo-American University Students." Report. 1984.

The study examined the differences of the attributions of Japanese-American university students. It also examined the relationships of attributions with achievement motivation, anxiety, and self-esteem. Attributions for success to one's effort were found to be significantly correlated with both achievement motivation and self-esteem in both groups. There were significant negative correlations found between attributions of success to the ease of the educational task and self-esteem in both groups. And attributions of failure to a poor educational environment were negatively correlated with achievement motivation for both groups.

Also for both groups, achievement motivation was not correlated with anxiety, but was with self-esteem. It was found that the Japanese-American students attributed success to external causes more than Anglo-American students. And Anglo-American students reported higher achievement motivation and self-esteem, while Japanese-American students reported greater anxiety.

Resnick, Harvey, John Viehe, and Sanford Segal. "Is Math Anxiety a Local Phenomenon? A Study of Prevalence and Dimensionality." Journal of Counseling Psychology 29 (1982): 39-42.

This study investigated factors related to math anxiety in college students and attempted to gain a better conceptual understanding of math anxiety. A little more than 1000 incoming freshmen students made up the sample. Small, but significant relationships were found between the MARS, the Mathematics Basic Interest, and the Academic Orientation. The MARS score for this sample was lower than samples found in other studies at other universities, which indicated that math anxiety can differ among differing university settings. It was found, though, that math anxiety as measured by the MARS is not unidimentional. Three factors of math anxiety were identified. They were evaluation anxiety, social responsibility anxiety, and arithmetic computation anxiety.

Roberts, Dennis M., and Edward W. Bilderback. "Reliability and Validity of a Statistics Attitude Survey." Educational and Psychological Measurement 40 (1980): 235-238.

This paper reported on the development and validation of using an affective measure to predict performance in statistics. Students with differing statistical background knowledge from The Pennsylvania State University were used as the samp e. Correlational data showed that the Statistical Attitude Survey (SAS) was a highly homogeneous scale that predicted course performance in statistics quite well.

Roberts, Dennis M., and Joseph E. Saxe. "Validity of a Statistics Attitude Survey: A Follow-Up Study." Educational and Psychological Measurement 42 (1982): 907-912.

The validity of the Statistics Attitude Survey was examined in this study. The subjects were 132 students enrolled in an introductory statistics course at The Pennsylvania State University. In this study all internal-consistency reliability estimates were found quite satisfactory. Also, males had higher SAS scores than females. And higher SAS scores were associated with a larger number of previous math courses, higher basic math skills, more previous statistical knowledge, and higher statistics course grades.

Sachs, Steven Mark. A Refinement of the Relationship Between Examination Performance and Mathemtics Test Anxiety. Diss. Nova University, March 1982.

This study investigated the relationship between incoming math skills, math test anxiety, and performance on the midterm exam of students at an urban community college in California. There were significant correlations found between high entering math scores and low math anxiety, low entering math scores and high math anxiety, entering math scores and midterm exam scores, and math anxiety level and math test performance.

Schofield, Hilary L. "Sex, Grade Level, and the Relationship Between Mathematics Attitude and Achievement in Children." Journal of Educational Research 75 (1982): 280-284.

Relationships between mathematics attitude and achievement in elementary school students were studied in connection with sex and grade level of the student, type of achievement test, and time of school year when measurements were taken. The relationship between attitudes and achievement were more significant in boys than in girls and more significant later in the school year than earlier in the school year.

Shanklin, Garth R. "Escape from Mathematics Anxiety as a Factor in Major Choice." Report. 1978.

The relationship between mathematics anxiety and academic majors chosen by incoming freshmen prior to enrollment and class attendence was studied. Differences in mathematics anxiety by sex were also investigated. The sample was made up of 1220 newly admitted freshmen at a medium sized western university. The Concept-Specific Anxiety Scale (CAS) was used to measure mathematics anxiety. It was found that students in higher mathematics content majors had significantly lower mathematics anxiety than those students in lower mathematics content majors and vice versa. It was also found that the females demonstrated significantly higher mathematics anxiety than males.

Siegel, Ross G., John P. Galassi, and William B. Ware. "A Comparison of Two Models for Predicting Mathematics Performance: Social Learning Versus Math Aptitude-Anxiety." Journal of Counseling Psychology 32 (1985): 531-538.

This study tested the ability of social learning variables to account for variation in math performance. The sample consisted of 97 women and 46 men who were undergraduates at The University of Maryland at College Park. It was found that specific mathematical skills, self-efficacy, and outcome expectations accounted for significantly more performance variation than did general mathematics ability, gender, sex-role orientation, and mathematics anxiety. Also, each of the variables of the social learning theory model--specific mathematical skills, self-efficacy, and outcome expectations--accounted for significant and unique increments in performance variation.

Suinn, Richard M., and Ruth Edwards. "The Measurement of Mathematics Anxiety: The Mathematics Anxiety Rating Scale for Adolescents -- MARS-A." Journal of Clinical Psychology 38 (1982): 576-580.

The authors thought a mathematics anxiety test for adolescents was needed. It was seen as a useful tool for helping them with attitudes toward mathematics during the years when career choices were being formed. This study's purpose was to develop a version of the MARS for adolescent testing, which was completed successfully. It was also shown that high mathematics anxiety was associated with low mathematics course grades.

Wahl, Mareene, and Frank Besag. "Gender, Attributions, and Math Performance." Report. April 1986.

This study compared and contrasted four variables on the types of attributions students made for their performance in an Algebra class. It was found with statistical significance that those students who had low math anxiety attributed their success to their ability more than those who had high math anxiety. And those students with low math anxiety also attributed failure to characteristics of the task rather than their own ability or effort. In addition, students with high math anxiety and low self-esteem attributed success externally and failure internally.

Wilhelm, Sharon, and Douglas M. Brooks. "The Relationship Between Pupil Attitudes Toward Mathematics and Parental Attitudes Toward Mathematics." Educational Research Quarterly 5 (1980): 8-16.

The primary purpose of the study was to examine the relationship between students' attitudes toward mathematics and parental attitudes toward mathematics. The sample consisted of 241 seventh, eighth, and ninth graders from a middle-class socioeconomic group. The Mathematics Attitude Inventory was used in the collection of data.

The highest correlations of anxiety toward mathematics were between the low achieving son and his father and between the low achieving daughter and her mother. There were also high correlations of anxiety toward mathematics between the middle achieving son and his mother and the middle achieving daughter and her father. The only significant correlations reported of self-concept in mathematics were between the low achieving son and his mother and the low achieving daughter and her mother. There was a high correlation between the middle achieving daughter and her father in enjoyment of math, while there was a negative correlation between the middle and high achieving sons and their fathers. And there was a negative correlation between the low and middle achieving sons and their fathers, while there was a positive correlation between the middle achieving daughter and her father in the value of mathematics in society. Also, males were more positive toward the teacher, females had a higher anxiety toward mathematics, and ninth graders viewed mathematics as more valuable than seventh or eighth graders.

Wooley, David. "The Effects of Sex and Anxiety on Mathematics Performance." Report. 1982.

The effects of sex, anxiety, and item difficulty on mathematics performance were studied. Sixty seventh, eighth, and ninth grade students were the subjects of the study. No significant sex related differences were found, but anxiety had a significant negative effect on mathematics performance.

Wright, Don. "Math Anxiety and Middle School Students." Report. November 1981.

The relationship between math anxiety and math achievement of seventh and eighth graders was studied. A significant negative correlation was found between the two.

ANNOTATIONS: TREATMENTS OF MATHEMATICS ANXIETY

Bander, Ricki S., Richard K. Russell, and Kathy P. Zamostny. "A Comparison of Cue-Controlled Relaxation Study Skills Counseling in the Treatment of Mathematics Anxiety." Journal of Educational Psychology 74 (1982): 96-103.

This study assessed the relative efficacy of three intervention strategies for reducing mathematics anxiety and enhancing mathematics performance in college students. The sample consisted of 20 males and 33 females. Enhanced study skills were the most efficacious conditions for reducing mathematics anxiety. Also, enhanced study skills and the development of relaxation skills helped to reduce general test anxiety and to improve mathematics performance.

DeBronas-Meade, Marie Louise, and Ric Brown. "Reduction of Mathematics Anxiety: A Cognitive Behavior Modification Approach." Report. March 1982.

This study investigated the efficacy of cognitive behavior modification in the treatment of math anxiety and investigated what other variables were associated with higher levels of math anxiety. Forty-four college and high school students were used as subjects. The MARS was used to assess the level of math anxiety. The cognitive behavior modification stressed the learning of relaxation procedures and desensitization hierarchies before the introduction of math homework. A significantly lower level of math anxiety was found following the cognitive behavior modification. Also, the subjects with higher math anxiety were more likely to worry about math, were female, had less encouragement by parents to study math, and had mothers with less education.

Gabel, Dorothy L., and Robert D. Sherwood. "Facilitating Problem Solving in High School Chemistry." Report. April 1984.

The main purpose of the study was to determine whether there were some types of instructional strategies that were superior to others in teaching problem solving with involved algebraic and proportional reasoning skills to high school chemistry students. Also, it was investigated as to whether particular strategies were more effective than others with students having differing degrees of math anxiety. The sample was made up of 609 high school chemistry students.

It was found that in every instance students with high math anxiety, as measured by the MARS, had lower achievement. And students with high math anxiety appeared to do better when less mathematical approaches and more visual approaches to problem solving were taught.

Hendel, Darwin D. "The Effects on Adult Women and Men of Participating in a Math Anxiety Program." Report. 1981.

The study investigated whether remediation programs had an impact on reducing math anxiety, increased participation in mathematics experiences, and increased competence in mathematics. A total of 772 individuals participated in at least one component of The Math Anxiety Program. This program significantly reduced the level of math test anxiety and numerical anxiety in the participants whose goal was to do so. Also, certain small percentages of participants had changed to more math-related occupations or felt more confident in their present occupations dealing with math as a result of the program. And a majority of participants stated that the program had given them more positive feelings toward math.

Kostka, Marion P., and Christine K. Wilson. "Reducing Mathematics Anxiety in Nontraditional-Age Female Students." Journal of College Student Personnel 27 (1986): 530-534.

This paper described the results of a program to help nontraditional-age women reduce math anxiety. Women, age 25 to 47, met for 11 two hour sessions. One hour of each session was spent building mathematical skills. The other hour was spent in promoting anxiety reduction. Significant changes occurred between pretesting and posttesting for the MARS and the Suinn Test Anxiety Behavior Scale. And in a questionaire given at the end of the program, all participants stated a greater confidence in their mathematical ability.

Lindbeck, Joy S., and Fay Dambrot. "Measurement and Reduction of Math and Computer Anxiety." School Science and Mathematics 86 (1986): 567-577.

This research was broken into two studies. The first was to develop an instrument to measure attitudes toward mathematics and computers. It was to be used in determining the effectiveness of a mathematics and computer anxiety-reducing workshop. Fifteen bipolar adjectives relevant to mathematics were used to assess attitudes toward solving mathematics problems and working on a course assignment on a computer. Data were collected concerning how many math courses were taken during high school and college. A mathematics placement exam was administered, and the MARS was used to measure mathematics anxiety. The second was to study the effect of a programming course upon the attitude toward mathematics and computers.

The math lab made no change in confidence or attitudes toward mathematics. The programming course gave no significant increase in mathematics attitude or mathematics confidence.

New Jersey State Department of Education. "Exploration of the Use of 'Programmed' Calculators in Remedial and Special Needs Math Programs at the Secondary Level." Report. 1979.

The long-term goal was to develop an instructional method to maintain interest in drill exercises associated with remediation for basic computational skills and to overcome math phobia. A programmable calculator with immediate feedback was used as the instrument for facilitating remediation. At the conclusion of the project, all teachers agreed that math phobia had been reduced in most students. And most of the students had developed a positive attitude toward the use of a calculator.

Resek, Dianne, and William H. Rupley. "Combatting 'Mathophobia' with a Conceptual Approach toward Mathematics." Educational Studies in Mathematics 11 (1980): 423-441.

The Math Without Fear Program was developed to help students overcome mathophobia. The program helped students who were basically rule oriented to become more concept oriented by helping them to understand the concepts of mathematics rather than just memorize rules of mathematics. In addition, it was found that rule oriented students were more likely to become concept oriented students if placed in separate sections of the course away from those students who are concept oriented already.

Smith, Jean Burr. "Data Collection and Descriptive Statistics for Effective Program Evaluation." Report. November 1983.

This study described a research design for evaluating a developmental math program, including statistics involving math anxiety. It was found that of the students who had used anxiety reduction techniques in their classes, a significantly larger number finished the class. And of those students who finished the class, a significantly larger number went on to take more and higher math courses.

Stevens, Phyllis W. "Computer Programs to Reduce Math Anxiety." Report. May 1982.

Twenty-four computer programs were developed by undergraduate students in a statistics course. Use of the computer programs did not decrease anxiety, hostility, or depression toward statistics. An increase in those variables, though, had a very high correlation with increased proficiency.

Strein, Leonard, and Richard M. O'Brien. "The Relative Efficacy of Negative Practice and Anxiety Management Training in the Treatment of Mathematics Anxiety." Report. April 1981.

The relative effectiveness of group negative practice and group anxiety management training in the reduction of math anxiety was studied. Seventy-two math anxious high school students were the subjects of the study. The group negative practice and the group anxiety management training significantly reduced math anxiety in the subjects, but made no significant difference in mathematics grades.

Wolfe, Mary L. "Development and Validation of a Pre-Post Instruction Course Evaluation Questionaire: A Pilot Study." Report. March 1985.

This study's intention was to begin developing and validating a short tool to measure more general attitudes toward research design and statistics, which included math anxiety in dealing with course material. The sample was made up of 54 female undergraduate students. There was a reduction found in math anxiety from the beginning to the end of the course, which lead to more interest and enjoyment in the research design course.

ANNOTATIONS: PREVENTION OF MATHEMATICS ANXIETY

Alexander, Livingston, and Robert Cobb. "Identification of the Dimensions and Predictors of Math Anxiety among College Students." Report. November 1984.

This study's purpose was to identify the independent dimensions underlying the MARS item responses, to develop factor scales to measure these dimensions, and to determine if specific personal and academic background variables can serve as predictors of math anxiety. The subjects were 197 students at a middle-sized state university. It was found that more anxiety was stimulated by math test related items than by numerical task items. There were no significant differences in age, sex, race, location of residence, total family income, or whether encouraged or discouraged to take math classes among math test related items or numerical task items. Students who had taken Algebra II in high school experienced significantly less math anxiety than those who had not. Also, those students who had A's and B's in high school Algebra and Geometry experienced significantly less math anxiety than those who had C's, D's, and F's.

Chapline, Elaine B., and Others. "Teacher Education and Mathematics Project. Final Report 1979-1980." Report. 1980.

Instructional modules were developed to attempt to reduce math anxiety in undergraduate elementary education students. They were developed to increase teacher skills and knowledge in identifying sex bias in the math classroom and in learning mathematical concepts, all of which were needed for elementary school instruction. Most students had a more positive attitude toward mathematics, were less math anxious, and were more confident in their math ability following the completion of the instructional modules.

Fennema, Elizabeth. "Teacher/Peer Influences on Sex Differences in Mathematics Confidence." Report. October 1981.

This study investigated the development of sex-related differences in confidence in learning math and the influence of that confidence on participation in the mathematics classroom. This study's subjects were 30 seventh and eighth graders from a midwestern city. It was discovered that teachers initiated more interaction with boys than girls, disciplined boys more than girls, and asked more questions of boys than girls. Also, boys initiated more interaction with teachers than girls. High confidence boys participated in class more than any others. And high confidence girls participated less than any others in class.

Furuto, David M., and Melvin Long. "Relationship of Self-Concept Enhancement to Anxiety and Achievement in College Mathematics." Report. March 1982.

The study investigated whether teaching strategies designed to help the student build a positive and realistic self-concept would effect a student's attitudes and anxiety toward mathematics and achievement in mathematics. The MARS and Mathematics Attitude Scale were used as measurement instruments. There was a significant difference found between the control group and the experimental group in mathematics anxiety, mathematics achievemant, mathematics attitude, and the coefficient of correlation for the relationship between mathematics ability and mathematics achievement.

Johnson, Gayle S. "An Investigation of Selected Variables and Their Effect upon the Attitude Toward Teaching of Elementary School Mathematics by Prospective Elementary School Teachers." Report. January 1981.

After several surveys and two exploratory studies were conducted, an Attitude Toward Teaching Mathematics Scale was developed. This scale tested variables that were found to be important to the teaching and learning of mathematics as shown by other tests. These variables were instructors, field experiences, mathematics achievement, and the impact of math anxiety. It was found from this pilot study that all of these variables do have an impact upon the amount of math anxiety reported.

Macfarlane, Jim, and Pat Crawford. "The Effects of Sex-Segregated Mathematics Classes on Student Attitudes and Achievement in Mathematics: A. Y. Jackson Secondary School, Year 1." Report. September 1985.

This study focused on the extent of the effects of segregated math courses upon participation rates, attitudes toward mathematics, and achievement in mathematics in both males and females. There were no significant changes found in students' attitudes, but males and females became more interested in careers involving higher math. Also, there were no significant differences found in students' achievement.

Sovchik, Robert, L. J. Meconi, and Evelyn Staines. "Mathematics Anxiety of Preservice Elementary Mathematics Method Students." School Science and Mathematics 81 (1981): 643-648.

This study attempted to find the reliability of the MARS and to find if taking a mathematics method course reduced the degree of mathematics anxiety. The subjects were 59 elementary education students at The University of Akron. The reliability of the MARS was found to be quite high, but there were no conclusive results as to whether the mathematics method course reduced the amount of mathematics anxiety in the subjects.

SUMMARY

It was apparent at the time this paper was written that most of the significant research literature available on mathematics anxiety dealt with the causes and correlates of mathematics anxiety. Much less significant research literature was available concerning the treatment and prevention of mathematics anxiety.

Mathematics anxiety was found to be significantly correlated and related to a number of other mathematical characteristics. These characteristics were most closely related to achievement in mathematics, attitudes toward mathematics, and sex differences in mathematics anxiety. Authors of studies stated that mathematics anxiety was negatively correlated to mathematics achievement (Austin-Martin, Wadell, and Kincaid 4; Kincaid and Austin-Martin 6; Wright 34). Others found that mathematics anxiety was negatively correlated to mathematics performance (Buckley and Ribordy 6; Dew, Galassi, and Galassi 582; Hendel, 1980, p. 222; Wooley 6). Two studies indicated that mathematics anxiety was negatively correlated to mathematics test performance (Buckley and Ribordy 6; Sachs 19). Also, mathematics anxiety was found to have negatively correlated to mathematics course grades (Meece 7; Suinn and Edwards 578).

There was a large amount of research that dealt with attitudes toward mathematics. It was found that negative attitudes toward mathematics correlated with high degrees of mathematics anxiety (Brown 66) and that mathematics anxiety

correlated negatively with the enjoyment and liking of mathematics (Miller 47; Payton and Lloyd 7). In a similar study, anxiety was found to increase as the mathematics content in an academic area increased (Docking and Thornton 7). But it was also found that students with high mathematics content majors had lower mathematics anxiety than students with low mathematics content majors (Shanklin 6).

Mathematical self-concept and confidence in mathematical ability also contributed to attitudes toward mathematics. Mathematics anxiety had a negative correlation to mathematical self-concept (Gourgey, 1982, p. 4; Gourgey, 1984, p. 9), to confidence in present mathematical skills (Butler 7), and to confidence in ability to learn mathematics (Austin-Martin, Wadell, and Kincaid 4). It was reported that students with high mathematics anxiety have negative attitudes toward success in mathematics and that students with low mathematics anxiety had positive attitudes toward success in mathematics (Kincaid and Austin-Martin 5). Also, low mathematics anxious students attributed success to their ability more than high mathematics anxious students (Wahl and Besag 3). And students with high mathematics anxiety and low self-esteem attributed success externally and failure internally (Wahl and Besag 3). In a similar report, it was stated that females with lower mathematics anxiety saw mathematics as more useful than females with higher mathematics anxiety. (Austin-Martin, Wadell, and Kincaid 4). And it was found that mathematics anxiety was

negatively correlated to future mathematical plans of students (Pedro, Wolleat, Fennema, and Becker 215).

Other relationships were found between mathematics anxiety and attitudes toward mathematics. Mathematics anxiety was correlated to the belief that mathematics was a male domain (Bander and Betz 319; Kincaid, Butler, and Austin-Martin 5). Another study found mathematics correlated with fear of negative evaluation and debilitating anxiety (Hendel, 1980, p. 228). Some relationships also existed between parental attitudes and student attitudes. It was found that the mathematics anxiety of a low achieving son correlated to the mathematics anxiety of his father, the mathematics anxiety of a low achieving daughter correlated to the mathematics anxiety of her mother, the mathematics anxiety of a middle achieving son correlated to the mathematics anxiety of his mother, and the mathematics anxiety of a middle achieving daughter correlated to the mathematics anxiety of her father (Wilhelm and Brook 10). In addition, mathematics anxiety was also correlated with the acceptance of erroneous beliefs about mathematics (Gourgey, 1984, p.9).

Sex differences in mathematics anxiety were found in a number of studies. Four separate studies all found that females had higher mathematics anxiety than males (Bander and Betz 319; Llabre and Suarey 284; Meece 5; Shanklin 6).

Some other miscellaneous correlates to mathematics anxiety were also found within some of the studies. Mathematics anxiety correlated with test anxiety (Dew,

Galassi, and Galassi 582; Hendel, 1980, p. 228). Low mathematics anxiety correlated with having played mathematics games as a child (Hendel, 1980, p. 228). Incoming mathematical skills of college students were found to correlate negatively with mathematics anxiety (Sachs 19). Also, mathematics anxiety was correlated to physiological arousal (Dew, Galassi, and Galassi 582). Mathematics anxiety was found to be made up of three factors--evaluation anxiety, social responsibility anxiety, and arithmetic computation anxiety (Resnick, Viehe, and Segal 42). And mathematics anxiety was found to be one of the predictors of mathematics avoidance (Chisholm 3).

As stated earlier, not nearly as many studies reported significant results concerning the treatment and prevention of mathematics anxiety as compared to those studies that reported on the causes and correlates of mathematics anxiety. In reference to the treatment of mathematics anxiety, some studies stated that the development of anxiety reduction techniques reduced mathematics anxiety (Kostka and Wilson 532; Smith 14; Strein and O'Brien 4), as well as the development of relaxation skills (Sander, Russell, and Zamostny 101; DeBronac-Meade 3). It was also reported that the learning of desensitization hierarchies helped reduce mathematics anxiety. Other studies reported that remediation programs designed to build mathematical skills reduced mathematics anxiety (Hendel 10; Kostka and Wilson 532). One study added that the use of a programmable calculator for immediate feedback in the remediation

procedure also helped reduce mathematics anxiety (New Jersey State Department of Education 13).

There were also a couple of miscellaneous treatments for mathematics anxiety that were reported by studies to be effective. One study stated that the enhancement of study skills reduced mathematics anxiety (Bander, Russell, and Zamostny 101). And another study reported the reduction of mathematics anxiety when students were taught to become more concept oriented rather than rule oriented in their development of mathematical skills (Resek and Rupley 427).

Even fewer significant studies were available that dealt with the prevention of mathematics. One such study stated that instructors had an impact on the amount of mathematics anxiety that was reported by students (Johnson 9). In reference to instructors, it was found that instructional modules that increased teacher skills and knowledge reduced the amount of mathematics anxiety reported by future classroom instructors themselves (Chapline and Others 65). Also, teaching strategies designed to build positive and realistic self-concepts resulted in lower levels of mathematics anxiety in students (Furuto and Long 15). And it was found that more anxiety was stimulated by mathematics test related items than by numerical task items (Livingston and Cobb 6).

CONCLUSIONS

Many correlates of mathematics anxiety were found by numerous researchers. These correlates basically fell into one of three categories. These catagories were mathematics achievement, mathematics attitudes, and sex differences in mathematics anxiety. Lower achievemant was related to higher mathematics anxiety, and higher achievement was related to lower mathematics anxiety. Negative mathematics attitudes were related to higher mathematics anxiety, and positive mathematics attitudes were related to lower mathematics anxiety. Also, females, in general, had higher mathematics anxiety than males.

The treatments of mathematics anxiety fell into two main categories. These were the use of anxiety reduction techniques and remediation of math skills. The development and use of anxiety reduction techniques reduced the levels of mathematics anxiety in students. Remediation programs designed to enhance mathematical skills also reduced mathematics anxiety in students.

Lastly, the prevention of mathematics anxiety began with teachers. It was found that future teachers, themselves, reduced their own mathematics anxieties by increasing their mathematical skills and knowledge. And it was found that teachers did have an impact upon the amount of mathematics anxiety within their own students. One method of reduced mathematics anxiety in students was to use teaching strategies that built positive and realistic self-concepts within the students. Additionally,

mathematics test related items stimulated more anxiety than numerical task items.

RECOMMENDATIONS

In the light of the significant results reported by the authors cited, it is recommended that teachers, when developing lesson plans and creating classroom environments, be fully aware that:

1) low mathematics anxiety can enhance mathematics achievement.

2) high mathematics anxiety can hinder mathematics achievement.

3) negative mathematics attitudes can be related to high mathematics anxiety.

4) positive mathematics attitudes can be related to low mathematics anxiety.

5) females, in general, can have higher levels of mathematics anxiety than males.

6) anxiety reduction techniques can reduce mathematics anxiety.

7) remediation which enhances mathematical skills can reduce mathematics anxiety.

8) the teachers, themselves, can have an impact upon the level of mathematics anxiety in their students.

9) mathematics test related items can produce more mathematics anxiety than numerical task items.

10) teaching strategies that build positive and realistic self-concepts can prevent the development of mathematics anxiety.

It is also recommended that researchers continue to study mathematics anxiety, especially concentrating the research

toward the treatments and prevention of mathematics anxiety, which presently has a limited amount of significant results available.

GLOSSARY

achievement motivation : motivation for achievement in a field for its own sake rather than for extrinsic reward (Woolfolk and Nicholich 595)

anxiety : apprehension, tension, or uneasiness characterized by fear, dread, or uncertainty (Good 34)

arithmetic computation anxiety : anxiety resulting from everyday situations requiring various forms of arithmetic manipulation (Resnick, Viehe, and Segal 43)

bipolar : having both positive and negative loadings of appreciable magnitiude (Good 233)

capacity : the ultimate limit to which an individual could develop any function, given optimum training and environment (Good 78)

causal attribution : an individual's perception of the causes of his or her own success or failure (Woolfolk and Nicolich 595)

coefficient of correlation : relationship between two sets of characteristics (Silverman 550)

cognition : the way humans think about and know things (Kimmel and Weiner 583)

cognitive behavior modification : technique used to change or adjust the cognitive behavior of an individual (Silverman 546)

concept oriented : having an understanding of mathematical concepts and flexibility in problem solving (Resek and Rupley 423)

control group : participants in a scientific experiment who, for the purposes of comparison with the experimental group, are not subjected to the independent variable (Silverman 550)

correlation : a statistical method that can determine the direction and strength of a relationship between variables (Woolfolk and Nicolich 597)

desensitization : therapeutic process by which traumatic experiences are reduced in intensity by repeated exposures of the individual to them either in reality or in fantasy (Good 174)

dominance behavior : behavior that operates to put the individual in the position of directing others or bending others to his will (Good 59)

effectance motivation : an intrinsic joy in the doing of something (Pedro, Wolleat, Fennema, and Becker 208)

evaluation anxiety : anxiety resulting from the anticipation and receipt of (mathematical) work to be evaluated, especially tests (Resnick, Viehe, and Segal 43)

experimental group : participants in a scientific experiment whose situation is altered for the purposes of comparison with another group of subjects, whose situaton is not altered (Silverman 554)

hierarchy : any graded organization, whether mental, physical, or social, in which each rank (except the highest) is subordinate to ranks above (Good 280)

instructional module : a group of students who follow the same course of instruction (Good 371)

MARS : Mathematics Anxiety Rating Scale (Richardson and Suinn 551)

mathematical self-concept : beliefs, feelings, or attitudes regarding one's ability to understand or perform in situations involving mathematics (Gourgey, 1982, p. 3)

mathematics anxiety : feelings of tension and anxiety that interfere with the manipulation of numbers and the solving of mathematical problems in a wide variety of ordinary life and academic situations (Richardson and Suinn 551)

mathematics avoidance : avoidance of math problem solving in a performance situation (Dew, Galassi, and Galassi 580)

mathophobia (also refered to as "math phobia") : excessive fear of mathematics (Resek and Rupley 423)

negative practice : a treatment of undesirable behavior by voluntary repetition of the behavior that is to be eliminated, largely for purposes of bringing the undesirable behavior to the level of consciousness (Good 383)

outcome expectation : a belief that the behavior will lead to a particular problem (Siegel, Galassi, and Ware 531)

pilot study : a study, usually of small scale, that tests new ideas by establishing a model for a larger program (Knowles, vol. i, p. 482a)

problem solving : the creation of a new solution to a novel problem rather than simply applying previously learned rules to the situation (Woolfolk and Nicolich 603)

quantification : the act of assigning, either arbitrarily or rationally, numerical values to observations that are commonly qualitative (Good 464)

relaxation procedures : a method of treatment that seeks to eliminate unnecessary muscular tensions and strains (Good 608)

remediation : corrective teaching (Good 489)

rule oriented : having a rigid reliance on rules without understanding (Resek and Rupley 423)

self-acceptance : seeing oneself as one really is; accepting and understanding one's interests, needs and abilities (Good 524)

self-concept : the group of ideas and feelings one has about oneself (Kimmel and Weiner 592)

self-efficacy : an individual situationally specific belief that he or she can successfully perform a behavior required to produce a given outcome (Siegel, Galassi, and Ware 531)

self-schema : the existance of networks of association used by the individual to organize and process self-relevent information (Lips 2)

sex-role identification : a self-awareness of being of one sex in which society prescribes the behaviors and roles (Liebert and Wicks-Nelson 592)

sociability : the ability of a person to communicate with others, especially in the nonvocational aspects of life (Good 538)

social responsibility anxiety : anxiety resulting from being responsible for fiscal or arithmetic matters in organizations and clubs (Resnick, Viehe, and Segal 43)

state : situationally determined aspect of how a person is reacting to a specific set of circumstances (Kimmel and Weiner 592)

statistical significance : the property of having low probability of occurrence on the basis of chance alone, thereby likely occasioned by factors other than chance (Good 534)

status : degree of acceptance or honor accorded an individual (Good 559)

test anxiety : fear of taking examinations; unpleasant emotional reaction elicited by anticipation of a testing situation; may have an effect on the test performance of the subject (Good 595)

trait : persistent tendencies of people to respond to their experience in certain charateristic ways, whatever the circumstances (Kimmel and Weiner 592)

trait anxiety : a general tendency toward anxiety proneness (Bander and Getz 313)

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